What is work and power? (review from Dec 21)
Work is Fxd if F and d are in the same direction. It is negative if they are opposite and zero if they are perpendicular.
Work is a scalar, units of Joule, J=Nm
Power is the rate of doing work
P=W/t - also a scalar with units: Watts, W=J/s

Volunteer to demonstrate their power.
(need? mass: = 63kg, time: d:
P=W/t = Fd/t = mgd/t =
63kgx9.8N/kgx0.21mx10steps/12.9s
63x9.8x0.21x10/12.9=100.507
100W
100/746=0.13 horsepower
746W in 1 horsepower
p199-203 Q1-6, 9-12 (skip angle questions, 7 and 8) CR 1.1-1.4

after 20 minutes - will go over Concept review questions together.
next class - simple machines

p203
CR 1.1 - Work is a measure of energy transfer that occurs when an object is moved over a

distance.
The effort required to move something.
CR1.2
The net work is zero because forces cancel, but the normal force does no work because it is perpendular to the displacement.

CR 1.3
Yeah, because there is a force and a displacement.
The friction force is not doing work because it is static with respect to the ground.
Your leg muscles push on your body core to get it to move.

CR 1.4
They can, the forces can act together to do work on the body. (same direction)
The could also cancel out and do no net work on the body. (opposite direction)

q1-6, 9-12

Block 2-4
What is work and Power?
Work is energy transfer through a Force acting

over a displacement. W=Fd where the force is in the same direction as d. Work is scalar - no direction but if F and d are opposite, then work is negative. F and d are perpendicular, W is 0.
units: Joule, J=Nm

Power the rate of doing work, P=W/t
unit: Watt, W=J/s

Volunteer to demonstrate stair running - power.
P=W/t = Fd/t = mgd/t = 72kg x 9.8N/kg x 0.205mx10steps/8.6s

72x9.8=705.6 N
705.6x0.205x10=1,446.48 J
P = 1446.48/8.6=168.1953 W
P = 1.7×10^2 W 746W in 1 horsepower
168.1953/746=0.2255
0.23 horsepower ignores the work done stepping down, slowing his body

work on p199-203 Q1-6, 9-12 CR 1.1-1.4
do CR first (skip q7 and 8 because they use trig, next year)

CR 1.1
energy transfer in a direction, a force acting through a displacement

CR 1.2
gravity does no work because the force is down but the displacement is horizontal - peperdicular W=0.
Friction is doing negative work as it slides down the alley.

CR 1.3
Is any work done when you walk? The frictional force is not doing work, because the friction is not acting through a distance, if your foot doesn't slide.

Your arms and legs go up and down, so they require work, so your muscles do work.

CR 1.4 - 3 forces on one body
Yes because the forces can all act in the same direction as the displacement.

If they are perpendicular, they do no work.

If they balance, the net work is zero as well.

Work and Power

What do we need for Vincent's Power
mass = 57 kg
distance = 20cmx 10 = 2.0m
time for 10 steps = 16 seconds
Work is change in energy and force acting through a displacement, W=Fd units: Joule, J=Nm
scalar - but is negative if F is opposite d
W = 0 if F is perpendicular to d
Power is the rate of doing work. P=W/t
units: Watts, W=J/s

P=W/t = Fd/t = mgd/t = 57kgx9.8N/kgx2.0m/16s
57x9.8x2/16=69.825
70 Watts 746W in a horsepower
70/746=0.0938 = 0.094 hp

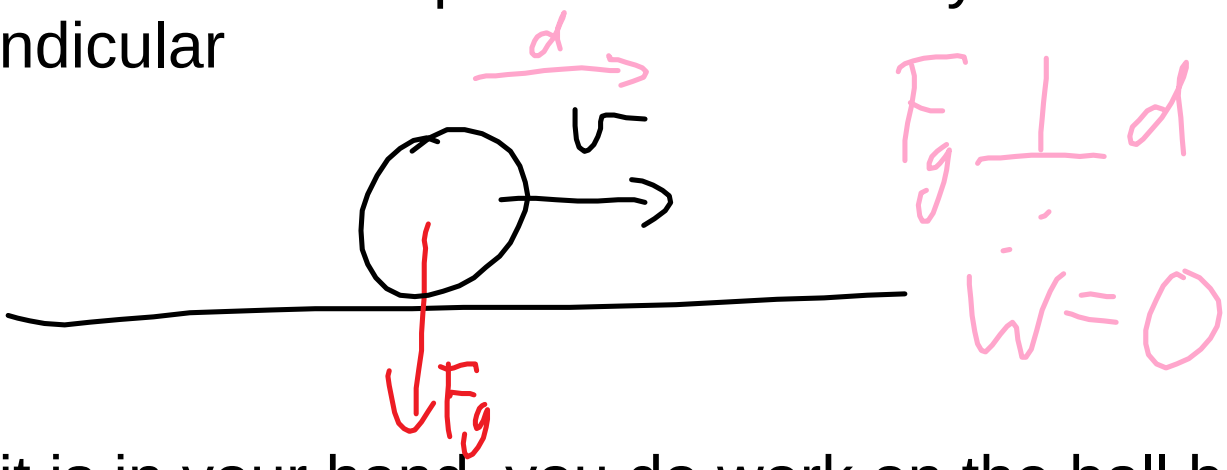
p199-203 Q1-6, 9-12 CR 1.1-1.4
(Q7 and 8 use vector components, skip)

20 minutes then we will call on students to read and answer Concept review questions

p203
CR 1.1
Work is the amount of force on an object over a

certain displacement.

1.2 Does gravity do work on the bowling ball?
there is force and displacement but they are perpendicular



while it is in your hand, you do work on the ball but as it slides, friction does negative work.

1.3 No, because the static friction doesn't act through a displacement - it doesn't slide.
Your muscles do work lifting your arms and legs when you walk.

1.4
3 forces act on an object, can they all do work?

Yes, if they are all in the same direction as the motion.

If they cancel out, the net work is zero.

If they are perpendicular to the motion, W=0

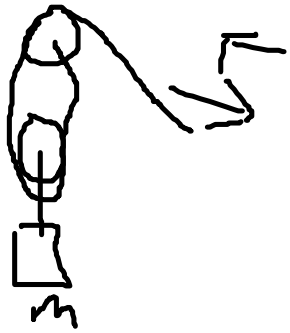
If they are opposite the motion, W is negative.

Next class/now (bulldog classic people, do problems at home)

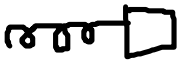
Simple machines, mechanical advantage and efficiency.

Simple machine:
Examples: lever

pulleys:

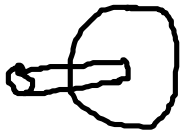


screw



inclined plane/wedge,

wheel and axel



simple machines can be used to make work easier, require less force over a longer distance or less distance with a larger force.
but work in = work out for an ideal machine
$F_{in}d_{in} = F_{out}d_{out}$

$F_{in}d_{in} = F_{out}d_{out}$

you push on the lever - input force and displacement

the lever lifts a weight - output force and displacement

Define Mechanical Advantage, MA = F_{out}/F_{in}

For an ideal machine (100% efficiency)
Ideal Mechanical Advantage, IMA = d_{in}/d_{out}

efficiency = W_{out}/W_{in} x 100 %

eg. you lift a 200g 10 cm mass using a lever. You have to push with 4.0 N over 6.0 cm. What is the

a) output force lifting the 200g mass?
b) ideal mechanical advantage?
c) Mechanical advantage?
d) efficiency?

a) F = mg = 0.2kg x 9.8N/kg = 0.2x9.8=1.96 N
b) IMA = d_{in}/d_{out} = 0.06m/0.1m = 6/10=0.6
c) MA = Fout/Fin = 1.96N/4.0N
1.96/4=0.49

d) efficiency = W_{out}/W_{in} x 100 %
= $F_{out}xd_{out}/F_{in}xd_{in}$ x 100 %
= 1.96x0.1/(4x0.06)=0.8167
= 82% efficient

next class homework: p210-211 Q13-16 CR 2.1-2.4

Friday lab - intro to energy